3.30 got rid of the second accentor. In this case poetical retribution was wrought, for while one of the turned-out accentors was placed in a white-throat's nest, and cared for by its foster parents, the young cuckoo was about a week afterwards found dead at the bottom of the nest.

Mammalia.—Dr. C. H. Merriam has reported to *Science* the discovery of an Aplodontia, show'tl or mountain beaver, which he believes to be sufficiently distinct from the ordinary form to take rank as a new species. Eight examples were taken in Placer county, Cal. The skull of this *A. major* is much larger and heavier than that of *A. rufa*, the occipital crest more highly developed, and the zygomatic arches more strongly convex. There are also differences in the color and pelage. A fœtal pigmy sperm whale (*Kogia breviceps*) has been received by the Smithsonian Institution. It is now proved that this species breeds in May.

EMBRYOLOGY.[1]

THE EARLY DEVELOPMENT OF JULUS TERRESTRIS.[2]—The eggs of *J. terrestris* are oval, white and covered by a thick chitinous chorion; the nucleus is embedded in a mass of protoplasm in the center of the egg. This central mass of protoplasm is irregular in shape, but its long axis corresponds with that of the egg. From it anastomosing processes radiate in all directions, forming a network throughout the egg, in the meshes of which the yolk-spherules are contained. The nucleus is not a distinct vesicle, but its position is marked by chromatin granules, and there is no nucleolus.

On the second day the nucleus and central mass divide into two parts, but this division is not complete, the two resulting masses with their nuclei remaining connected by a network of protoplasm. The two segments then again divide in the same incomplete manner, so that there are now four segments connected together. On the third day the formation of the blastoderm begins, some of the segmentation masses making their appearance on the outside of the ovum at different points, so that the development of Julus resembles that of Geophilus as worked out by Sograf. The cells in the interior of the yolk are the direct descendants of the first segmentation masses, and constitute the hypoblast.

The fate of the hypoblast cells is various; some are employed in the formation of the mesoblastic keel, that is, in the formation of the splanchnic and somatic mesoblast. Another part gives rise to the hypoblast of the mesenteron, and a third portion remains in the yolk after the mesenteron is formed, and gives rise to mesoblast cells which are employed in the formation of various muscles and the circulatory system.

[1] Edited by JOHN A. RYDER, Smithsonian Institution, Washington, D. C.

[2] F. G. Heathcote, M.A. Proc. Roy. Soc. London, Vol. XL, No. 242, pp. 73–76. (Read Jan. 21, 1886.)

With regard to the retention of the primitive union of the cells of the ovum until this stage, nothing of the sort has been described before, except by Sedgwick in Peripatus. The most important part, it seems to me, is not the connection of cell to cell, but of layer to layer by means of processes of the cells.

About the middle of the fourth day several of the hypoblast cells approach the epiblast in the middle line of what will eventually be the ventral surface of the embryo. This is the beginning of a mesoblastic keel such as Balfour described for Agalena.

The epiblast cells in the ventral middle line, after altering their shape, increase by division and take a considerable share in the formation of the keel. The hypoblast cells below them also increase, and on the fifth day the mesoblastic keel is complete, in the formation of which both epiblast and hypoblast have taken part. The keel is still present on the sixth day, but the cells composing it are becoming elongated in a plane parallel to its surface. They then spread out to form two definite splanchnic and somatic layers of the mesoblast below the epiblast. These two layers are connected. The keel disappears on the seventh and eighth days, and on the ventral surface the epiblast cells assume a columnar form, thus giving rise to the ventral plate.

The mesoblast now becomes thicker on each side of the median line, both layers being concerned in this thickening, where they become indistinguishable. Outside the thickenings, that is, farther away from the middle line, the two layers are closely applied to each other and to the epiblast, as before. It thus results that the mesoblast is mainly arranged in two parallel longitudinal bands along the ventral side, these bands being connected across the middle line by a thin portion consisting of a single layer.

These bands now begin to be segmented into mesoblastic somites from before backwards, their position corresponding with that of the future segments of the body. There are at first eight somites, corresponding with the eight segments of the embryo when hatched. These somites are at first solid; afterwards a cavity appears in them.

Early on the ninth day the stomodæum is formed as an invagination of the epiblast near one end of the ventral surface. Shortly after the formation of the stomodæum the proctodæum appears as a shallow somewhat wide invagination of the other end of the ventral surface.

The body segments now become more apparent, each being marked by a deep transverse furrow in the epiblast. The hypoblast cells are still present within the yolk, but are gradually becoming collected in the median line, just below the mesoblastic bands. The stomodæum and proctodæum become more deeply invaginated, extending a considerable distance into the yolk, and at the

same time the hypoblast cells begin to form the mesenteron, arranging themselves around a central lumen.

On the tenth day the ventral flexure is formed by a deepening of the transverse furrow between the seventh and eighth segments. As this furrow deepens and the embryo increases in size, the last segment grows in length. At the same time the embryo curves round toward the ventral surface, the end segment being bent round against the head. The eighth segment is longer than the others except the head. Even as late as the twelfth day, when the nervous system is far developed in other parts of the body, in the eighth segment the tissues are imperfectly differentiated, the nerve cords not showing any ganglia, but lying on the epiblast and not quite separated from it. At a later period of development the anal segment is constricted off from the eighth, while from the anterior part of the latter, the additional segments formed in the course of development are derived. These additional segments are therefore intercalated between the seventh and ninth.

Just before the appearance of the ventral flexure the embryo develops a cuticular envelope over the whole surface of the body. This is the so-called amnion of Newport. Just before the formation of the ventral flexure the nervous system is formed. The first traces of this consist in a thickening of the epiblast on each side of the middle line; this is soon followed by the formation of a shallow furrow between the thickened parts; this longitudinal furrow corresponds with that described by Metschnikoff in Strongylosoma.

The bilobed cerebral ganglia are formed first, and the nerve cords are formed from before backwards, a pair of ganglia being present for each segment except the last. The posterior portion of the nerve cords is completed at a considerably later stage of development. The nerve cords are widely separated, but are connected by a thin median portion. In later embryonic life they are closely approached to one another, and almost form one cord.

On the eleventh day the embryo has increased considerably in size. The ventral flexure is complete, and the animal lies with the long end segment folded closely against the rest of the body, the end of the tail being against the stomodæum. The nervous system is now completely separated from the epiblast, and the epiblast has assumed the adult form. It now separates a second membrane like that which is formed on the tenth day.

The splanchnic layer of mesoblast covers the mesenteron, the stomodæum and proctodæum.

Within the yolk, which is still present in great quantity in the body-cavity, there are present a number of hypoblast cells. These, as has already been mentioned, give rise to the circulatory system and to various muscles. They may, therefore, be now con-

sidered as mesoblastic cells which have been directly derived from the hypoblast.

On the twelfth day the Malpighian tubes are formed as blind outgrowths of the proctodæum, the nervous system is further developed, and the first rudiments of the appendages begin to appear. Late on this day the animal is hatched with only the rudiments of its appendages.

An investigation of the development of Geophilus by Sograf[1] shows that the early cleavage of the egg of Chilopods is very similar, not only that, but even the formation of the mesoblastic bands and cœlomic cavity is similar. Great numbers of cells also remain in the yolk in this form until a late period and apparently migrate outwards, and may possibly take a share in forming certain mesoblastic structures. There is, however, no evidence to show that the yolk lies immediately within the body-cavity in either Geophilus or Lithobius, but rather within the mesenteron, so that in this respect the Chilopods differ pretty widely in their development from the Diplopods, as described by Heathcote. It may be that the splanchnic mesoblast may indirectly acquire accessions of cellular elements from the underlying walls of the mesenteron, even in the Chilopods, but of this there is no very clear evidence, except in the case of one of Sograf's figures. The Malpighian tubes develop in the same manner in Geophilus as in Julus; and, while there is no clearly defined anal segment developed as in the latter, the somites are formed from behind forwards between the first-formed segments and the terminal section of the body, where the proctodæum is invaginated. The wall of the mesenteron is the last structure from which the yolk-spherules disappear in the Chilopods, and finally the lumen of the mesenteron appears surrounded by a second nearly homogeneous investment of yolk which lies within the hypoblastic wall of the mesenteron, and in which free multipolar cells are embedded. There occurs a dehiscence of cells into the cœlom from the splanchnic mesoblast investing the mesenteron. These free cells represent blood cells. The process is somewhat analogous to that observed in embryo fishes, in which blood cells are freed from the periblast of the yolk, the periblast, though undoubtedly occupying the position of the hypoblast, has, on account of the peculiar way in which the yolk is finally excluded from the ventral side of the intestine, taken up the position of a splanchnopleure in relation to the somatopleure, which covers not only the viscera but also the yolk, so that the latter in fishes may be considered to be intraäbdominal, since the periblast or what represents the splanchnopleure, at least in part, is in many cases a transitory structure, leaving no trace of itself in later embryonic life. Were the lumen of the intestine, however, to originate in

[1] In contributions from the Laboratory of the Zoölog. Museum in Moscow, Vol. II, 4to, 1883. (In Russian.)

the same way in fishes as in Myriopods, viz., as a direct canalicular vacuolization of the yolk passing through its central longitudinal diameter, the periblast would doubtless then represent the hypoblast or what it did in very primitive fish-like forms, while externally it would have been covered by a true splanchnopleure which had been developed in advance of the permanent hypoblast of the mesenteron, though the latter had been primarily derived from the primitive hypoblast.

The eggs of the Myriapoda, it is to be remembered, represent a very peculiar type, that is, they at first have the germinal matter concentrated in the center, but as development proceeds the germinal matter, after segmentation into a number of cells, is repelled centrifugally or to the outer surface of the ovum. The primary segmentation therefore occurs in the center of the egg and not at one side or superficially until some progress in segmentation has been made at the center of the egg. This probably characteristic mode of development seems to distinguish, in a measure, the Myriapoda from other Arthropoda, since in no other arthropodous form does the vitellus so constantly occupy a superficial position and so completely invest the first segmentation cells, which are then aggregated in a cluster at the center of the egg.

THE DEVELOPMENT OF AGELENA NÆVIA.[1]—In the memoir, the place of publication of which is here cited, William A. Locy has very carefully worked out the development of the spider (Agelena), and obtained a number of new and important morphological results. He finds that there is at first a peripheral layer of protoplasm present, and that the nucleus of the first segmentation is central and imbedded in plasma. This first nucleus subdivides and gives rise to new nuclei, each invested by plasma. These migrate to the periphery of the egg and appropriate the peripheral layer of protoplasm or "blastema." In this way a hollow blastoderm is formed. Just before the primitive cumulus is formed a depression appears at the point where the latter develops, and it appeared not improbable that this depression represents the first portion of the blastoderm of the spider's egg which becomes invaginated. Later, and about 80° from the primitive cumulus, a second thickening appears in the blastoderm; this second thickening spreads rapidly and becomes shield-shaped. Between the two the intervening blastoderm then becomes thicker, thus leading to the development of the ventral plate.

The protozonites or first indications of somites are then formed from the cephalic and caudal plates. Two somites arise from the former and they bear the cheliceræ and pedipalpi; the other somites develop from the caudal plate, and give rise to the ambulatory and rudimentary pairs of appendages. The embryo still presents a transversely banded appearance in the third as in

[1] Bull. Mus. Comp. Zoölogy, XII, No. 3, 1886, pp. 63–103, Pls. 12.

the preceding stage. Sections show that the cavities of the limbs are prolongations of the cavities of the corresponding mesodermic somites. The nervous system at first consists of two rows of ganglia, one to each somite; these are widely separated in the middle line, except in the head and tail lobes, where those of opposite sides are fused. The stomodæum arises as an invagination between the ganglionic thickenings of the cheliceral somites, and immediately below the ventral margin of the cephalic plate.

About the time that the ventral flexure appears, or when the embryo becomes folded upon itself, the proctodæum, heart, lungs, trachea, spinning glands and muscles develop. The chelicerae and pedipalpi appear as postoral structures, but in the course of further development they appear as preoral appendages. At an early stage the proctodæum is enlarged by the outgrowth of its dorsal wall; from this diverticulum the so-called stercoral pocket of the adult is formed. The lateral nerve cords are finally approximated in the middle line, and the posterior or abdominal portion of the nervous system degenerates. The poison glands appear as groups of enlarged cells at the bases of the cheliceræ. The spinning glands develop from the ectoderm in the anal region on the ventral side of the proctodæum. The lungs arise as infoldings from a large oval pair of masses of cells, the nuclei of which are arranged in parallel lines. From these cells the lamallæ of the lungs are formed. The heart remains open below for a time, communicating freely with the yolk. The aorta, at a later period, is constricted off from the mesenteron. At least two pairs of the provisional appendages on the abdomen are modified into the spinning mammillæ. The remnant of the upwardly flexed tail persists for some time as a postanal knob; its tip represents the morphological end of the body.

The eyes are developed as invaginations of the ectoderm (hypodermis). The retinal involution becomes constricted off from the ectoderm entirely, and then lies just below that portion of the hypodermis which afterwards becomes the vitreous body. In a concave depression, on the surface of the latter, the lens arises as a lenticular thickening of the cuticula. The mode in which the light traverses the eye is essentially similar to the method in which the light reaches the percipient elements of the retina in the vertebrate eye.

EMBRYOLOGY OF ARMADILLOS.—It is a belief among the people of South America that armadillos bring forth only male young. Dr. von Ihring, of San Paolo, communicates to *Cosmos* some important observations he has made on this and other points in the history of the development of the armadillo *Praöpus hybridus.* He states that all the fœtuses taken from two females presented the external characters of males only. He also states that several fœtuses—six or more—are enclosed in a single chorion,

which is surrounded by as many zonary placentæ as there are fœtuses, the placentæ not, however, forming perfect zones. He finds the ungual phalanges at this period to differ entirely from that of the adult. Instead of being long and claw-shaped, they are wide and hoof-shaped, with a trilobate margin, as in the extinct genus Gyptodon. This is highly interesting as exhibiting the law of acceleration modifying that of heredity. The sexual characters are probably like those of the hyænas, in that the female fœtus has a clitoris so large as to give her a close resemblance to the male.—*E. D. Cope.*

PSYCHOLOGY.

GAMBETTA'S BRAIN.—The *Revue* recently (November 21st, 1885) gave the weight of Gambetta's brain, according to M. A. Bloch. This weight, which was remarkably light (1160 grammes), evidently ought to be considered as an entirely secondary element in a proper estimate of the diverse qualities of the organ. At a recent session of the Society of Anthropology (March 18) Professor Mathias Duval communicated a very interesting report in which he brought out and gave their due value to certain structural details of this brain—to certain characteristic elements which must be regarded as far outweighing the simple consideration of the gross weight of the organ. Compared with the brains of individuals known to have been possessed of but little intelligence, and representing types of reduction of the third frontal convolution, the brain of Gambetta, besides other peculiarities, shows a type of extreme development of that convolution. This development is such that not only are the secondary convolutions more numerous and more complicated than those of ordinary brains, but, besides this, the "cape" is double.

This development is evidently in favor of the localization discovered by Broca, who held that the third frontal convolution was the seat of speech. M. Mathias Duval has also pointed out the two following peculiarities, the significance of which he has not been able to determine.

(1) The right quadrilateral lobule is very complicated, and is divided into two parts by a sulcus which starts from the occipital fissure. The lower of these two parts is subdivided into many secondary convolutions by the presence of a fissure with numerous branches arranged in star-like patterns.

(2) The occipital lobe is notably reduced, especially upon the right side.

M. Mathias Duval thinks therefore that Gambetta's brain should be considered refined (*beau*)—although the expression does not appear to him scientific—in the sense that it preserves, especially in the frontal region, in spite of the complication of its folds, a regularity which may be called schematic.—*Revue Scientifique, April 3d, 1886, p. 444.*